

The Chemical Age

A Weekly Journal Devoted to Industrial and Engineering Chemistry

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Fire-Fighting Chemicals

FIRE fighting, once the specialist job of the professional fireman, has now through circumstances outside our control become the concern of almost every individual of the population. Time was when with reasonable care the average man could reckon on passing his whole life without being called upon to deal with any outbreak of fire; to-day, an incendiary bomb may at any time fall from the skies and start a first-class conflagration in house or factory demanding to be tackled by anyone at hand.

Quite naturally, the Government has taken the leading part in investigating how best incendiary bombs shall be put out. The Ministry of Home Security has issued a circular adverse to all chemical methods of dealing with this problem and claiming that nothing that has been brought to the attention of the Ministry has shown any significant advantage over water. There appears to be some doubt in the minds of the Ministry as to how water should be used. According to official proposals the individual should lie flat and spray the bomb with a fine jet of water from a stirrup pump or hose; according to official tests which have been brought to our notice the experts of the Ministry direct a fierce jet of water upon the bomb, thus blowing the flaming fragments of magnesium in all directions. Those who have tackled incendiary bombs will probably agree with us that neither method is of very much use and that sand or earth is better than either in the early stages. There are many cases, however, where an incendiary bomb cannot be dealt with by solid materials and must be sprayed with some liquid. It is thus of the very greatest importance that a really efficient method shall be used, and that the best method shall be made available. It would be of the greatest interest to have the views of the chemical industry upon this subject of chemical preparations *versus* water in dealing with the incendiary bomb.

It is fairly evident that so long as a thermite or self-oxidising type of incendiary is burning nothing can be done to extinguish it, but all efforts must be directed to preventing the heat or flaming fragments from setting fire to surrounding objects. Moreover, the intense atmospheric disturbance caused by the high temperature must involve a continuous supply of any fluid used to surround the bomb in order to isolate it. Foam or other forms of carbon dioxide are thus of doubtful value in these early stages. Moreover, foam requires a special installation and would thus only be available in works. On the other hand, a blanketing form of extinguishing vehicle would be suitable for oil bombs or other forms of incendiary which must obtain their

oxygen from the air. For the oil bomb water would be quite unsuitable except in dealing with the 'surrounding objects.'

A great deal depends upon the nature of the "surrounding objects." In the great majority of incendiary fires starting in houses, offices, and public buildings, skilled fire-fighting personnel are not available, and the surrounding objects are the usual inflammable materials used in buildings. Apart from the nature of the agent which starts the fire, these conflagrations are in no wise different from those to which we are normally accustomed. In dealing with these the three classes into which the U.S. Underwriters' Laboratory have divided, fires may be usefully employed. These "domestic" fires come under three headings: (1) Incipient fires in which the cooling and quenching effects of water are of the first importance, *i.e.*, fires of combustible materials such as paper, wood, and textiles. The matter goes a little farther than this, however, because the incendiary bomb itself must as far as possible be smothered, especially if it be an oil bomb, and thus these fires also come under the second heading. (2) Incipient fires in which the blanketing or smothering effect of the blanket used must be of the first importance, *i.e.*, fires of small quantities of rapidly burning material such as oil, grease, petrol and varnish—to which we would now add incendiary bombs. Most works fires will also come under these two headings, but many of them will also come under the third heading. (3) Incipient fires in electrical equipment where the use of a non-conducting medium is essential.

Our general conclusion would be that the agent used for putting out a fire must depend to some extent on the skill of the operator and to a very large extent on the nature of the problem raised by the surrounding bodies. It seems very unlikely that water is in fact the best material for fire fighting or even for directly dealing with incendiary bombs, but it is certainly the safest for the inexpert private citizen to use. A proviso which we would make in regard to fire-fighting chemicals in general is that whatever materials are supplied for the purpose should be manufactured by reputable chemical manufacturers who can be trusted to have sound views upon the matter and to use only materials of the highest quality. It is necessary that the substances used for the purpose shall be suitable chemically, and it is equally important that they shall be of good quality and unadulterated. The issues at stake are too serious and the potentialities of loss and danger too great for risks to be taken by utilising possibly inferior products.

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NOTES AND COMMENTS

Science and Defence

THE above is the title of a communication made by Professor A. V. Hill, M.P., Sec.R.S., to *The Times* this week; though actually the sub-title, "Anglo-American Partnership in Research," is more fully apposite to the material that follows. Taking as his text the election of Dr. Conant to "foreign" membership of the Royal Society, Dr. Hill indicates that in fact American membership of any scientific society in this country is becoming less and less foreign, and that in any case the Royal Society belonged as much to Dr. Conant's ancestors as to ours. One good thing that the war has caused is the strengthening of the links between British and American science, and Dr. Hill indicates the interesting series of steps which have been taken to co-ordinate plans for scientific defence, starting from the foundations laid before the war. In the stirring times of the moment we are perhaps apt to forget how much we owe to such institutions as the American Rhodes scholarships, the Commonwealth Fund fellowships, and the Rockefeller research fellowships, which have made for a continual interchange of scientists between Britain and the United States. Dr. Hill's words really form an extension of his address on national and international science delivered earlier this year to the Parliamentary and Scientific Committee (see *THE CHEMICAL AGE*, March 1, p. 122); he again stresses the point that it was the men of science, both in America and here, who first woke up to the fact that the Nazi persecution was directed against the independence of science and of learning generally; and that it was the men of science who first offered hospitality to the victims of this persecution. Now the men of science are co-operating actively as well as passively, and pooling their knowledge into a common store for the defence of liberty of thought and study. This co-operation must not be suffered to come to an end when the war ends; it can and should carry over into time of peace. Readers of *THE CHEMICAL AGE* will appreciate that our policy has been to give generous space to news of chemical developments in the United States, thus placing on permanent record in this country some account of their industrial and technical achievements, and aiding to the best of our ability the cause of Anglo-American co-operation.

Wholesale Prices in May

THE Board of Trade Index Number for wholesale prices of industrial materials and manufactures for the month of May is 154.7 (1930=100); for chemicals and oils the figure is 126.1; for iron and steel 181.0; and for non-ferrous metals

124.1. Compared with the April figures, that for chemicals and oils represents a decrease of 0.1 per cent.; and that for non-ferrous metals a similar decrease. For iron and steel there was no appreciable change. In the past twelve months (that is, since May, 1940) the respective increases are 0.1, 18.5, and 0.3 per cent. Among the chemicals and oils there was an increase of 12 per cent. in the price of iron sulphate and a decrease of 5 per cent. for carbolic acid, but these items are of relatively small importance to the group as a whole. The aggregate increase in the price of industrial materials and manufactures since the outbreak of war is 51½ per cent. and in comparison with last month the rise was 0.3 per cent.

"White Coal" from Scotland

A GOOD deal of comment in the Press, particularly the Scottish Press, has lately been devoted to the proposed scheme for utilising for industrial purposes the water-power of the Highland valleys, Glen Affric and Glen Cannich. Views both for and against the proposal have been expressed, often with some heat, and a good deal of confused thinking has bubbled to the surface, but to our mind the problem is a fairly simple one. The real point at issue is whether the scheme is likely to be of advantage to the country as a whole, or whether "white coal" is a white elephant. Those who support the project on the ground that it will bring industry and renewed life to the depopulated Highlands are, to our way of thinking, a little disingenuous. Similar projects carried out, both in Britain and abroad, have benefited, not the people on the spot, but comparatively remote industrial areas, by providing cheaper power than was previously obtainable. If any district is to benefit from the Highland power scheme it is more likely to be the industrial Central Lowlands of Scotland. Of course, sentiment plays a large part in the matter, and the question arises whether it is worth while to despoil, aesthetically, a beautiful and characteristic region for economic benefits elsewhere, when these benefits are, at the moment, problematical. Is regionalism, in fact, to be completely disregarded? Supporters of the scheme point to the industrial benefits that "white coal" has brought to Italy and to Sweden; but its opponents fairly say that those countries have no supply of real coal readily available. One thing is quite certain; it is not the dwellers in the Alpine valleys in Italy who have gained by the damming of their rivers; on the contrary, they have lost some of their best land. So that the decision should really rest on the answer to the question whether the Highland water-power is essential to the country as a whole; it will certainly be of no particular use to the Highlands themselves.

Substitutes in Germany

REPORTS of the use of substitute materials in Germany have been recently published, quoted principally from an article in the *Berliner Börsen Zeitung* describing the methods employed at the Robert Bosch works to overcome various shortages caused by the British blockade. Aluminium, as might be expected, found many uses in replacement of copper and brass, and mica was replaced by paper for insulating purposes, and by pottery in high-performance plugs. Figures are quoted to show the comparative consumption of certain materials in the Bosch works in 1938 and 1940. Among these the most striking is the reduction in nickel consumption from 33,800 kg. to 100 kg. Copper used fell from 163,500 kg. to 20,700 kg., and rubber from 213,500 kg. to 42,900 kg. Tin and lead consumption showed only slight falls and the comparative figures for aluminium, which no doubt would show a large rise, are not quoted.

THE INTERESTS OF CONSULTING CHEMISTS and public analysts in Australia will be conserved by the formation of a professional body called the Australian Association of Consulting Chemists. With headquarters at Melbourne and branches in other States, the Association now includes about 80 per cent. of the consulting chemists of the Commonwealth. The council of the Association has appointed Mr. John A. Gourlay, of 341 Collins Street, Melbourne, as registrar.

Metallic Complexes in the Dyestuff Industry

Connection Between Structure and Colouring Power

by G. S. RANSHAW

ABOUT the year 1929, chemists of Scottish Dyes, Ltd., made an important discovery which had a superficial resemblance to the discovery of ultramarine, which happened in a Leblanc soda furnace. Both discoveries were fortuitous, and subsequent investigation of the phenomena entailed resulted in a useful corroboration of theoretical views and the introduction of a new product to commercial manufacture. The discovery of the phthalocyanines, a description of which will find its place later in the present article and which gave rise to the Monostral pigments and dyes, entailed a thorough investigation into the structure of organic metallic complexes and laid the foundation for further important work with definite practical applications in the dyestuff field.

The organic metallic complexes which are the subject of the present study may be defined as bodies formed by the action of secondary valencies which incorporate the metallic element in a closed ring. Such bodies exist in an immense variety and there is no strict method of classifying them. Following M. A. Wahl, however, they can be divided into bodies where only one secondary valency enters the ring as in the metallic derivative of glyocoll, shown in Fig. 1, and into bodies where two secondary valencies appear, as in

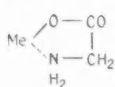


Fig. 1.

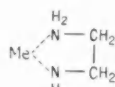


Fig. 2.



Fig. 3.

Fig. 2. A third series of compounds have two secondary valencies in the ring, but differ from the foregoing in that these spring from two different atoms (Fig. 3).

The first and second types of ring can contain five or six atoms, and whilst attempts to enlarge the number have failed as regards the monocyclic compounds, bi- and polycyclic complexes have been produced. These rings may either be identical or different one from the other. Copper glyocoll, for instance, contains two rings of the first type (Fig. 4), but there are innumerable cases of polycyclic complexes containing rings of both the first and second species, nickel, copper and iron compounds containing three rings having been described in the literature. A common feature is that all these derivatives belong to *o*-hydroxy or amino-substituted aromatic molecules, and it is a point of interest that the metallic derivatives of *o*-oxyazoic compounds are analogous to those metallic complexes which have undergone the former substitution, as seen from the following formulae:—

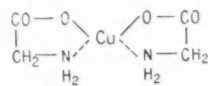


Fig. 4

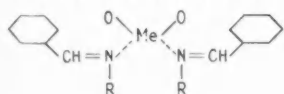


Fig. 5.

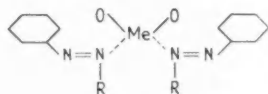


Fig. 6.

Application to Azoics

It was in an early German patent of 1893 that mention was first made of the interesting fact that metallic lakes or complexes could be formed on certain compounds containing the azo group, $-N=N-$, in that if wool dyeings obtained by means of *o*-oxyazoic colours were subsequently treated with a solution of potassium bichromate (acidified) the shade was improved and increased fastness resulted. The patent mentioned was soon abandoned owing to unsuitability in the colours chosen, but it was undoubtedly the forerunner of a whole series of chromed colours derived from the halogenated,

nitrated and sulphonated *o*-aminophenols which attained considerable importance in wool dyeing.

No attempt had been made, however, to isolate the lakes as metallic complexes with these azoic colours, although in the early patent literature of the Badische Anilin und Sodafabrik chromium complexes of oxanthraquinone sulphonic acid, azoic derivatives of the *o*-aminophenols and naphthols, and of anthranilic and salicylic acids were mentioned. The real importance of the principle was not appreciated until 1915, and the CIBA concern was ultimately responsible for the extensive developments which then took place. This firm's German patent 298,670 of October 7, 1915, covers chromium complexes obtained by heating the *o*-aminophenols with chromium compounds, diazotising and coupling with appropriate components. These dyes, in the semi-chromed state, could then be completely saturated by further reaction with the chromium salt. The method has undergone numerous modifications and has since been applied to an enormous number of *o*-oxyazoic colours; chromium, too, is not the only metal incorporated. CIBA describes copper compounds of direct colours for cotton containing the J-acid molecule, urea compounds of J-acid, etc. A useful development, finally, was the use of nickel, iron, cobalt or manganese complexes as pigments for varnishes on account of the solubility of the latter in cellulose ester solvents.

A large number of metallic complexes with simple azoics have been described in the literature, the simplest being the copper complex of *o*-oxyazobenzene (Fig. 7). This derivative crystallises in brownish-bronze needles, the nickel in green needles. Benzene-azoresorcin forms analogous complexes. Those with copper are stable to alkalis, those with nickel less so. The sulphonated examples

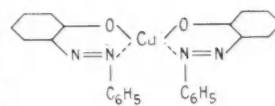


Fig. 7.

have the greatest practical interest, since they constitute the Neolan, Inochrome, and Palatine Chrome colours.

The chromium complexes, being the most important, have best been studied as to constitution, in particular the complexes furnished by colours derived from coupling salicylic acid and diazotised bases: aniline, *m*-nitraniline, *o*-toluidine, etc. From the work of Brass it is concluded that these contain an atom of chromium, two salicylic acid residues and two molecules of water. The chromium here is hexa-coordinated. This constitution is modified by the presence of a substituent in the *ortho*-position in the azo-group. Thus *o*-chloraniline/salicylic acid forms a complex with two atoms of chromium, three salicylic acid residues and 3 molecules of water, whilst *o*-anisidine/salicylic acid (Alizarine Yellow 5G) gives a complex containing one atom of chromium, three molecules of colour and three molecules of water.

From the extension of these reactions to the compounds of pyrrol appears a relation between these complexes and the porphyrins on the one hand, and the phthalocyanines already mentioned on the other. Benzene-azo-pyrrol, for instance, forms a nickel complex with the structure of Fig. 8. An exhaustive study has been made by

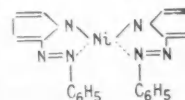


Fig. 8.

Drew and Lindquist of the copper compounds formed with the various groups of *o*-substituted azo colours, and their conclusions as to the nature of the atomic linkages confirmed, in principle, theoretical ideas previously held. The copper played the part of co-ordinating element, just as did the other metals. When in the co-ordinated compound the valencies of the metallic element are satisfied, *i.e.*, when the number of groups or atoms

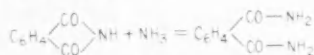
linked with it corresponds to the co-ordination number, the complex will not fix other molecules (H_2O , NH_3).

One of the most recent developments in this field is due to the discovery by the I.G. Farbenindustrie that metallic complexes with azo colours are not obtained exclusively from oxyazo compounds, but that complex-formation takes place when there is a methoxy or ethoxy group in the *ortho*-position. And the $O.C_2H_5$ or $O.C_2H_5$ groups often react in a more advantageous manner. Under the action of appropriate metallic salts the ether oxide function is hydrolysed. This permits the use of *o*-anisidine, *o*-phenetidine, dianisidine, etc., which are more easily diazotised whilst the coupling is more regular.

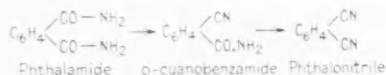
The principle has given rise to a large range of colours: the reaction is not limited to the monoazoics, but has been extended to the di- and polyazoics.

The Phthalocyanines

The fortuitous development of the phthalocyanines mentioned in the introductory paragraph resulted from the observation that in the course of the manufacture of phthalimide a bright blue coloured pigment was often produced, and investigation soon established that it resulted from the action of the phthalimide (or from the action of ammonia on the phthalimide) in presence of the iron of the apparatus. B.P. 322,169 covered the 1929 discovery and the subsequent scientific study of the nature and structure of the pigment was delegated to Professor Linstead of the Imperial College of Science. Elementary analysis showed that it contained carbon, hydrogen, nitrogen and iron, but no oxygen. The ratio of carbon to nitrogen was 4:1. The absence of oxygen indicated that the phthalic acid residue had been dehydrated, probably by the preliminary formation of phthalimide under the influence of ammonia:—



The phthalimide then loses successively two water molecules:—



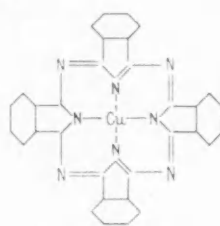
It is the two latter compounds which furnish coloured pigments when heated with various metallic salts; these pigments have great stability and possess the general formula $(C_{32}H_{16}N_8)X$, where X is a bivalent metal. The fundamental compound of the group is therefore $(C_{32}H_{16}N_8)H_2$, which has been designated phthalocyanine. It is generally prepared by starting with the metallic phthalocyanine derivative, which is then deprived of its metal atom.

The fundamental reaction for the preparation of the metallic phthalocyanines consists of reacting *o*-dinitriles with metallic salts. Thus, by heating phthalonitrile with cuprous chloride the copper pigment is obtained:—

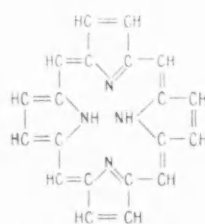


However, the cupric chloride which is formed reacts in its turn with the phthalonitrile giving a cupric chloro-phthalocyanine, the result being a mixed product. A recent improvement developed by Imperial Chemical Industries, Ltd., consists in heating phthalic anhydride with urea, copper chloride and boric acid.

Copper phthalocyanine is commercially available as Monastral Fast Blue B and its introduction was a great success owing to its excellent stability, which ensured its superiority over Prussian Blue and other pigments sensitive to alkalis, and Ultramarine which is sensitive to acids. The work of Professor Linstead already quoted resulted in its being given the following formula, comprised of four isoindole rings surrounding a central copper atom:—



Monastral Fast Blue



Porphyrin Structure

Fig. 9.

Fig. 10.

(The compounds exhibit resonance and consequently the double bonds are placed in purely arbitrary positions.)

The resemblance between the copper phthalocyanine molecule and the fundamental structure of the porphyrins (a group of natural pigments, e.g., haemoglobin and chlorophyll, are compounds of porphyrin with metals) is seen from the juxtaposition of the two.

Since the discovery of the fundamental reaction a great number of derivatives from the substitution of phthalimide or the -dinitriles have been investigated. When sodium amyl-oxide is used, sodium phthalocyanine is obtained from which the sodium can be removed by acid treatment to give the metal-free phthalocyanine (Monastral Fast Blue G). Lead phthalocyanine provides a bright green pigment. Finally, phthalocyanine derivatives soluble in water have been obtained either by sulphonating the copper complex or by commencing with sulphonated derivatives of phthalimide. For instance, when the ammoniacal salt of a tetra-sulphonated phthalic anhydride is heated with urea and copper chloride a tetra-sulphonated copper phthalocyanine is obtained which forms blue crystals with a metallic sheen. These form a dye for natural silk and vegetable fibres; the alkaline earth salts are insoluble, however, and find a useful application as lakes for lithographic inks.

Thus the chemistry of these complexes, which raised problems of valency and structure finally resolved by the Werner co-ordination theory, has had important practical consequences, and has resulted not only in an amplification of the range of synthetic colouring materials available, but has given an insight into the connection between structure and colouring power which is most important.

Institute of Physics

Formation of Industrial Radiology Group

THE formation of an Industrial Radiology Group under the auspices of the Institute of Physics has been announced. Its object is to provide a medium for the exchange of information on the practice of radiography and X-ray crystallographic analysis in industry. A committee has been appointed representing those employing X-rays in industry and the manufacturers of industrial X-ray apparatus and films. Membership will be open to all interested, whether members of the Institute of Physics or not. Fuller details will be published soon. Those interested may register their names with the honorary secretary, Dr. L. Mullins, A.Inst.P., of the Research Laboratories, Kodak, Ltd., Harrow, Middlesex.

New Steel Alloys

Swedish War-Time Development

IN a lecture before the Association of Swedish Technologists, the Swedish mining engineer, Einar Ohman, stated that new kinds of alloyed construction steel, with a very small nickel content or with no nickel at all, had been developed in Sweden, on account of the import difficulties.

Since the beginning of the war research to obtain such alloys has been carried on at various Swedish steel works, and it is now possible to recommend for general use new kinds of steel in which the alloy metals are mainly manganese, chromium, and, in certain cases, molybdenum.

In evolving the new alloys the Swedish metallurgists have been partly guided by experience gained in America and Germany.

Notes from Works Safety Jottings

Taking-Over and Personal Responsibility

by JOHN CREEVEY

FREEDOM from accidents where chemical plant is in continuous operation depends very much upon good co-operation between persons leaving and taking-over at each change of shift. For this reason, apart from all else, it is essential to enter up the plant log or report sheets conscientiously, making prominent note of any change in operating procedure or any abnormal conditions that have been observed. To "take-over" without becoming fully conversant with what has happened during the preceding shift is likely to be sheer folly; each chart, as well as the plant log or report sheet, should be examined, if only for the purpose of being assured that recorders and indicators are working. Should abnormal conditions have arisen during the preceding shift, it is well to have the oral comments of the person in charge as well as his written report. With perfect co-operation, this taking-over can be done speedily and efficiently and it becomes a real asset in the operation of the plant.

Apart from merely taking-over, it is desirable to have additional assurance that all is in order by personally "checking-up" on valves and switches, as well as other accessory features. Each valve should be tried to make sure that it is functioning normally; each safety device should be examined, in manner permissible, to ascertain that nothing abnormal has passed unobserved during the preceding shift. If fitters are at work on some accessory part of the plant, such as a pump, the precise state of affairs as regards progress should be noted. The presence of men engaged in maintenance or repairs may mean that some feature of the plant may be temporarily put out of use as a measure of safety, apart from the actual part engaging the attention of the fitters. If the men are temporarily absent, nothing unusual might be noticed were it not laid down by works regulations that prominent warning of "fitters working" be displayed at those points from which operations are controlled. Plant operations which are particularly hazardous must suggest their own safety precautions as regards taking-over from one shift by another.

In the early days, when chemical plant was developing to the stage which has now been reached, leakage from tanks and pipes in the form of occasional drip or overflow was of common occurrence, and precautions to avoid personal injury became established somewhat in the nature of commonsense. A wet area on the floor surface gives indication of spillage of liquid, which could easily be leakage from an overhead source such as tank, pipe joint, or valve. The first step in investigation is therefore to move to a point where it will be safe to look up without risk of injury to face or eyes. An overhead leak that cannot be put right immediately is a danger to all who have occasion to pass the point where the liquid is dripping, in consequence of which a prominent warning should be displayed.

Abnormal conditions which are observed on chemical and related plant must be reported to the appropriate responsible person. But furthermore, irrespective of this, it must be noted that some emergencies call for safeguarding of the situation before anything else is done. Unexplained conditions must be reported immediately; if cause is indicated, steps are taken to rectify the conditions as shown by experience in operating the plant concerned. The assurance that all was in order when taking-over from the preceding shift goes a long way to provide calmness in handling anything unexpected. Abnormal conditions may be detected at their earliest by constant observation of indicating and recording instruments, with quick resourcefulness in noting a change that would not normally take place. In many cases experi-

ence will instinctively tell that "something is not what it should be." For this reason chemical plant workers should be given opportunity to gain experience in operating different types of plant under variable conditions, as far as that may be practicable at the works where they are employed. A man with experience is well adapted to normal routine of the works, and likewise resourceful in emergency circumstances.

Every person employed in industry should know something about safety generally and in particular about the work he is entrusted with. Every such person must look upon safety as a subject sacred to himself and to his fellow-workers. The eyes should be trained to observe automatically, and the mind to respond quickly to the need of reporting things which offer danger to others. Any urge to experiment in the matter of doing a thing some other way than that which is recognised must be sternly disregarded; methods which appear to be better can be suggested to some responsible person, and then they can be tried out under supervision if permission is obtained. There may be a particular reason for not doing a thing in the manner which comes to mind. Someone in a responsible position at the works knows that there is unsuspected danger, and that experience has called for things to be done as they are done at present.

Chemical plants, likewise the chemical laboratory, are not the place in which to indulge in practical jokes. This must be firmly impressed upon junior workers, and even upon some persons of more mature years. Electrical equipment must be recognised as dangerous, and demanding great respect. The operation of valves and switches is entrusted only to certain persons, and for anyone else to touch them is a crime. A practical joker should be discharged from the works as soon as his presence is revealed, no matter how valuable as a worker he may be.

To ensure safety in its widest sense it is desirable for all workers to know something about their work apart from the immediate routine concerned. Knowledge of the reason for doing a task this way rather than that creates interest in the task and avoids a tendency to monotony. The importance of every man's work as part of the whole routine of things must be emphasised, for by this means workers gain a measure of responsibility, and if they are good citizens and fellow-workers they will take pride in their tasks and simultaneously acquire the art of doing things safely for the benefit of all as well as for themselves.

Manganese in the United States

Large Imports from British India

UNITED STATES production of manganese ore, containing 35 per cent. or more manganese, during February, the last month for which statistical records are available, was 2500 long tons, shipments were 2400 tons, and producers' stocks at the end of the month were 2300 tons, according to the Bureau of Mines, United States Department of the Interior. In January, production was 2100 tons, shipments were 2200 tons, and producers' stocks at the end of the month were 2200 tons.

General imports of metallurgical manganese ore (35 per cent. or more Mn) imported in February amounted to 91,369 long tons gross weight, with a manganese content of 44,928 long tons. Of these figures, British India accounted for 59,785 (25,385) long tons; the Union of South Africa for 26,143 (12,913), and Cuba for 11,923 (5619).

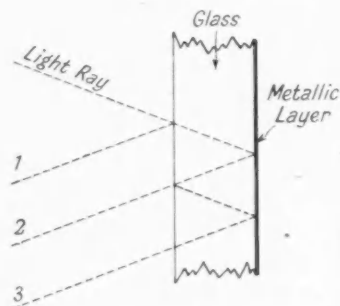
Metallic Films for Front-View Mirrors Silver, Aluminium, and Rhodium

by BRUNO SCHWEIG, Ph.D.

NOWADAYS all mirrors, with a few insignificant exceptions, are made by utilising the reflection from metal surfaces. Fortunately for the glass industry, when it is desired to have the best class of work, these metals must be laid on glass. There are, of course, some mirrors which consist of highly-polished metals without glass, but these are usually very small and of the type used for ladies' handbags or shaving mirrors, and show certain defects. Besides, their surface is rarely as even as the glass surface.

The normal method of manufacturing mirrors is to deposit a metallic film on glass. Usually this metallic coating is on the back of the glass because it is easier to produce and, in addition, the reflecting surface has the protection of the glass in front of it, while the back may be covered by any suitable means such as varnish, paint, or electrolytically deposited metals. These mirrors are perfectly satisfactory for ordinary purposes, but they have two disadvantages from a scientific point of view. In the first place, both the front and the back of the glass each gives a reflection of its own, and consequently there is a double reflection, while there might even be more by interaction. This defect gives different images, destroying clearness and distinctness, and is particularly troublesome with optical and astronomical instruments.

The adjoining sketch shows a light-ray which is reflected from both the glass surface in front (1) and the metallic coating behind the glass (2) and in addition again from the metallic layer (3) after reflection from the front to the rear.



It is easy to see this multiple reflection if a finger is held vertically against a thick glass mirror and looked at from the side, when at least two different images of the finger-tip will be distinctly observed. There is a further disadvantage

where the reflecting surface is at the back of the glass in that the light has to travel twice through the thickness of the glass, in this way losing strength and possibly changing its colour according to the thickness and colour of the glass. This loss occurs in both the visible and the invisible part of the spectrum, and attempts have consequently been made to create front-view mirrors that would eliminate it.

The difficulty in making these front-view mirrors is to find a highly reflecting metal which will adhere to the glass surface and at the same time will not tarnish or lose its reflecting power when exposed to the atmosphere, while being sufficiently hard to withstand cleaning. These reflecting films are so thin that they need a backing to support them, and glass is usually chosen for this purpose on account of the remarkably smooth and flat surface which can be obtained.

The requirements with which the reflecting film must comply limit the choice of possible metals to practically three, namely, silver, aluminium, and rhodium. Silver has the highest reflecting power, about 95-97 per cent. As long as the visible part of the spectrum is in question, in which the reflection of silver is practically the same over the whole field, a silver film would be the best, but there are difficulties in its application. The silver is deposited by one of the well known methods; a solution of silver nitrate in water and ammonia is reduced either by inverted sugar and alkali, tartaric acid, Rochelle salt, or formaldehyde, or by a combina-

tion of some of these reducing agents, and frequently special chemicals for hardening the coating and preventing pinholes are added. When the coating is thick enough it is then polished, but the adhesion of the silver to the glass is not firm enough to withstand repeated cleaning, and in addition the surface tarnishes relatively quickly when exposed to the atmosphere. As a result, in order to produce a more durable mirror, the silver surface must be covered. A very thin, transparent lacquer would be the best, but the application is difficult, and lacquers show bubbles and in drying tend to give an orange-peel effect to a certain extent. Further, the lacquer itself would act as an additional reflecting medium, and consequently the use of silver films for front-view mirrors is not general for optical and astronomical work, where a high degree of accuracy is required.

Cathode sputtering of silver in a high vacuum gives a very much softer coating and no better results. Plating with rhodium has been tried, but up to the present without any real success. Experiments are still continuing, however, and are referred to later in these notes.

Aluminium Surface Mirrors

Up to the present the best surface mirrors for scientific purposes have been obtained with aluminium, but their production requires very skilful technique. The method adopted employs a high degree of vacuum, of the order of 10^{-4} to 10^{-5} mm. of mercury. The aluminium is vaporised in this vacuum and deposited on the glass surface. It is essential that the glass should be absolutely free from every trace of dust and grease. The vaporising is carried out by heating small pieces of aluminium wire hanging on tungsten coils which in turn are heated by passing an electric current through them. The aluminium forms a very bright film with a reflection of about 90-94 per cent., and its adhesion to the glass is so good that the surface can be cleaned without fear of damaging it or rubbing it off. It is very resistant to atmospheric attack, probably on account of the formation of a very thin layer of aluminium oxide which acts as a protecting coating, and it retains its reflecting powers for a considerable period. At the same time there is no great variation in the reflection of different wave lengths, whether in the visible or the invisible part of the spectrum. These aluminium mirrors are therefore specially employed for photographic and astronomical purposes, and their applications include the two huge telescope reflectors at Mount Wilson and Mount Palomar, U.S.A.

Experiments with Rhodium

Mention has already been made of the use of a rhodium film and experiments and work are still being carried out to this end, as it is felt that the use of this metal would eliminate the disadvantages of the aluminium. A certain amount of success has been achieved in depositing the rhodium directly on to the glass, the method adopted being the same as that used for the manufacture of aluminium mirrors. It still remains to be seen, however, whether this rhodium front-view mirror is superior to aluminium. Polished rhodium surfaces have a reflection efficiency of not more than 80 per cent., but the inventors of the process claim that reflection is practically the same over the whole of the visible spectrum, that the adhesion of the film to the glass and the mechanical hardness of the film are excellent, that the mirrors can be cleaned without damage, and that temperatures up to 400°C. have no effect on the reflection or the adhesion. In addition, most chemicals, even in strong concentration, do not attack the metal surface. The mirrors can be manufactured in any thickness of deposit and are therefore especially useful for

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Underground Coal Gasification

Progress in Russia Reported

REPORTS from Russia paint a roseate picture of the new stations for underground gasification of coal in the Donets Basin and Moscow coalfields. A modern gas-plant of this nature, they say, "does not bear the faintest resemblance to the familiar old coal mine. The huge iron, concrete and glass buildings that house the shops, the highly-mechanised processes, the small neat workers' settlement near by, all speak of an up-to-date modern industry. The main buildings and structures are approximately in the centre of the coalfields. To the right and left of the central plant buildings, pipe mains run, some of them to the bounds of the deposits where the underground gas generators are situated.

"The underground gas generator may well be called the heart of the station. It consists of several bore-holes of large diameter, a few dozen yards apart, which run from the surface of the ground right down to the coal beds. Below, in the coal seam, these bore-holes are connected by a system of white-hot drifts. An oxygen-and-steam blast is fed into one of the bore-holes, and from the others adjacent to it the combustible gas comes out and is piped away.

Molecules as Miners

"The oxygen-and-steam blast passing through the coal seam along white-hot drifts enters into chemical reaction with the combustible part of the coal. A product of this reaction, in the form of gas, passes out through the nearest bore-hole to the surface. In other words, molecules of oxygen and steam replace men as miners. And it is precisely these molecules that do all the heavy labour underground. But they work economically, and bring to the surface only the combustible part of the coal, leaving the ash behind in the seam.

"Of all the shops, the one producing oxygen is the most impressive. It is a plant in itself, with a capacity of about $2\frac{1}{2}$ million cu. ft. of air an hour. This means that it feeds the underground gas generators with (approximately) 530,000 cu. ft. of a 95 per cent. oxygen blast at the same rate. In a year it also turns out about 17,700 cu. ft. of a krypton-xenon mixture. These inert gases, krypton and xenon, are used to fill electric light bulbs. They prolong the life of the bulbs and effect a saving of 20 per cent. in the consumption of electricity.

"Everywhere, in all the shops of this unusual enterprise, the latest and most powerful machines and chemical apparatus have been set up; compressors, vacuum pumps, rectification columns, scrubbers, etc. Physical work is a thing of the past here. All the labour processes are mechanised. The service personnel is simply a handful of workers, most of them women. Everywhere there is light, and plenty of it. Everything is spick and span, and at every step one hears the quiet hum of machinery operating almost noiselessly."

The report goes on to describe the method of power production and the system of control lamps, of various colours, indicating the amount of energy under consumption, and the quantity of the various products turned out. Sulphur and carbon dioxide are removed from the gas before it is piped off to the consumer. An account of the development of this system of coal gasification in Russia was published in THE CHEMICAL AGE on March 1 (1941, 44, 1131, p. 121).

Hazards of Carbon Tetrachloride

Interesting Cases Recorded

CARBON tetrachloride is a compound of wide industrial use. Despite the fact that its rather high degree of toxicity is very well known, it continues to be employed because of its inexpensiveness, its efficiency as a fat solvent and cleanser, and because it is one of the few incombustible organic compounds.

The incidence of carbon tetrachloride poisoning deserves some brief consideration. Since it is not a reportable disease, it is difficult to obtain an accurate idea of the frequency with

which cases occur in industry. Figures from the annual reports of the Department of Labour and Industries in Massachusetts, reported in "Chemical Safety News" from *J. Indust. Hyg. Toxicol.* (1941, 23, 3), show that this poisoning is a relatively uncommon condition. In Massachusetts in 1935 there were 12 cases of carbon tetrachloride poisoning out of 311 industrial accidents due to harmful materials; in 1936 there were 16 cases out of a total of 391; and in 1937, 10 cases out of 515. Expressed in percentages, from 1.9 per cent. to 4.1 per cent. of industrial accidents due to harmful materials were attributable to carbon tetrachloride. In Connecticut in 1936/37 the percentage was only 0.36.

Poisoned after Fifteen Years

Two cases reported in detail show great variation in character. In one case the worker had been foreman for 15 years in a workroom where spray-painting of refrigerators was carried out, and the refrigerator boxes cleaned with carbon tetrachloride, about one gallon of which was used daily. The only source of ventilation in the workroom was an upward suction draught in a walled-off painting cage. The ventilator was turned on only when actual painting was being done and it was observed that visible fumes of paint leaked out round the door of the cage into the main room. Refrigerants used were methyl chloride, sulphur dioxide, and difluoro-dichloromethane, but no leakage of these was observed. The valves of the freezing unit were calibrated in a bath of *o*-dichlorobenzene. A gallon of CCl_4 , if allowed to evaporate in a room of the size in question (30 ft. by 30 ft. by 60 ft.) would give a concentration of 600 p.p.m., well above the prescribed safety minimum of 100 p.p.m.

In the second case a workman who had been engaged for three years cleaning fur pelts with trichlorethylene, was supplied with carbon tetrachloride for the first time as a substitute owing to non-delivery of the usual cleaning material. Before noon on the first day he felt symptoms of nausea, and within the week was admitted to hospital. Certain observers have claimed that exposure to chlorinated hydrocarbons greatly increases the susceptibility to the toxic effects of CCl_4 , but this is not borne out by experiments with animals.

Contrast of Susceptibility

The outstanding feature in the examination of these cases is the contrast in susceptibility to CCl_4 poisoning shown by the two men. In the first case the patient became ill after several years' exposure (though his fellow-workers in the same room are not reported to have shown any distressing symptoms). In the second case the onset of illness took place after less than four hours' exposure; here the average concentration in the air of the workroom would have been well below the toxic minimum, though the local concentration in the air actually breathed by the patient must have been very high.

It is a noteworthy fact that the first patient was by no means an abstainer from alcohol, which is credited with being an important factor in increasing susceptibility to CCl_4 vapours; whereas in the second case the workman stated that he very rarely consumed alcohol, and in fact was actually taking special pains to keep himself in good physical condition in view of a forthcoming medical examination for police employment.

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the production of semi-transparent mirrors. Their disadvantage lies in their high price and the relatively small reflecting power.

In a similar way surface mirrors of chromium and, for special purposes, of silicon can be produced. Nickel mirrors made by depositing nickel from a gaseous compound of the metal are used only for electrical, not for reflecting appliances. In conclusion may be said that there is considerable future in the production of a front-view mirror with high reflecting power, strong adhesion of the metallic film to the glass backing, and good durability of the film, if all these can be provided at a reasonable cost.

Synthetic Rubber Tested

High Resistance to Petroleum

FOLLOWING a year's testing of the B. F. Goodrich Company's synthetic rubber, "Ameripol," the company has now announced that the synthetic product is superior to natural rubber in four important characteristics and can be substituted for the natural product in 769 out of 1000 cases in the field of mechanical rubber goods, provided, of course, that the question of cost is not an important consideration. In various compound states, the synthetic material is already being widely used in aeroplane de-icers, aviation and petroleum hose, and in many mechanical applications where it is in contact with acids, oil and grease, benzol, and carbon tetrachloride. The tests are said to show that the synthetic substance excels natural rubber in resistance to ageing, oxidation, heat, and oil; equals it in range of hardness, elongation, tensile strength, permanent set and in resistance to abrasion, acids and alkalies, and is slightly below natural standards in elasticity, tear resistance, and reaction to temperatures below freezing. It is claimed, however, that improvement is possible here by skillful compounding of the synthetic product.

Ameripol is similar in appearance to natural crude rubber, and can be tubed, calendered, frictioned, spread, milled, and vulcanised like natural rubber, according to the report. Special cements have been developed which will permit vulcanisation and adhesion to metals, including brass, provided that the metals can be suitably roughened by sand or shot blasting. Resistance to mineral, animal, and vegetable oils and fats, to the oxidising influence of the metallic soaps used as driers in paints and inks, to heat, and to abrasion, particularly in the presence of oil, are said to be among the most valuable fundamental properties of the synthetic product. Compounds can be made in the same hardness range as those of natural rubber and elongation is given as about the same. Tensile strengths can be varied by the materials used in the compounding. Best quality compounds of the substance are reported to have been obtained with black pigments. Tear resistance of the best Ameripol compounds is reported to be somewhat lower than that of the best compounds of natural rubber. Abrasion resistance under normal conditions is about the same, although tests showed that at high temperatures and in the presence of oils the synthetic product is superior in this respect. But the synthetic rubber is outstanding in resistance to all products derived from petroleum. The maximum swell for any all-synthetic stock as tested by the company would probably never exceed 10 per cent. While the maximum shrinkage in the case of very soft stocks will normally not exceed 20 per cent. These percentages are claimed to be much lower than those of corresponding compounds made from hard or soft natural rubber.

Fertiliser Prices

Subsidy for Phosphates and Lime

THE Government has decided to continue for the year beginning July 1 the policy of stabilising prices of agricultural fertilisers, involving a substantial and increasing subsidy from the Exchequer to fertilisers in general. In these circumstances, and in order to facilitate a reorganisation of distributive arrangements and to economise transport, the Government has decided to discontinue the special basic slag subsidy which has been in operation under the Land Fertility Scheme since 1937, and to utilise the money which would have been devoted to it, together with the money involved in the price-stabilisation policy, for the benefit of phosphatic fertilisers generally. This arrangement, it is submitted, will have the effect of creating a more logical price structure, and it will be possible to secure some reduction in the price of superphosphate, particulars of which will be announced at an early date.

Subsidy payments on lime will be continued not only for the forthcoming year, but until the end of July, 1944. This assurance is designed to encourage producers of lime—particu-

larly of ground limestone—to extend their plant. The Government is taking active steps to increase supplies. It is proposed that the responsibility for the administration of the lime subsidy shall be undertaken directly by the agricultural Ministers as from August 1 next, and full use will be made of the administration machine so efficiently developed by the Land Fertility Committee.

The distribution of superphosphate, basic slag, and potash will be controlled in order to ensure the most efficient utilisation of supplies. The details of the scheme of control are under active consideration, and will be announced shortly.

A CHEMIST'S BOOKSHELF

SPECIFICATIONS AND METHODS OF ANALYSIS FOR TAR OIL WINTER WASHES. London: H.M. Stationery Office. Pp. 22. 6d.

This useful little bulletin (No. 122, Ministry of Agriculture and Fisheries) is the outcome of investigations made into the constitution of ovidical tar-oil washes by a committee representing the Association of British Insecticide Manufacturers and the Ministry of Agriculture. The specifications and methods of analysis which it includes have been adopted by both parties, with the concurrence of the Government Chemist, and most manufacturers of the washes have agreed that their products shall conform to the standards laid down. Our actual knowledge of "tar oils" is still far from complete, and the work in hand refers only to washes—whether of the miscible oil or the stock emulsion type—compounded from distillates from horizontal or vertical retort tar or from coke oven tar. The specifications in each case cover total oil content, content of oil soluble in dimethyl sulphate, phenols content, distillation range, and stability. Reagents and apparatus are fully detailed, and an appendix comprises specifications for dimethyl sulphate.

ANNUAL REPORTS ON THE PROGRESS OF APPLIED CHEMISTRY, 1940. Vol. XXV. London: Society of Chemical Industry. 16s., to members 7s. 6d.

In spite of war-time restrictions this volume continues to be as comprehensive as in previous years, such alterations as there are merely affecting the arrangement of the contents. The title of the report on "Intermediates and Dyes" has been changed to "Intermediates and Colouring Matters"; "Oils, Fats, and Waxes" becomes "Fats, Fatty Oils, and Detergents"; and the review on "Leather and Glue" is restricted to "Leather" alone. Material concerning "Essential Oils" is no longer bracketed with "Fine Chemicals and Medicinal Substances," but forms part of a separate review entitled "Essential Oils, Isolates, Derivatives, and Synthetics." In all there are 26 reports; each shows that same care and attention which has given the book an international reputation for thoroughness, and the systems of indexing and referencing are as full and accurate as ever. The increase in price to non-members of the Society from 12s. 6d to 16s. was inevitable in the present circumstances and Society members should indeed be grateful that the blow has not fallen on them also.

Saving has become the watchword of the nation and is rapidly becoming a highly-developed virtue in industry. Cellulosic waste, however, has proved difficult to dispose of economically. The Nesfield Deane stoker has accordingly been produced by the FISCHER DEANE ENGINEERING CO., LTD., 17 Victoria Street, London, S.W.1. The stoker, which is described in an illustrated brochure just issued, consists essentially of a mechanical feed chamber and a combustion chamber. The manufacturers claim it has many advantages in the economic utilisation of the waste as a means of raising steam.

The May edition of *Deco Trefoil*, published by the DENVER EQUIPMENT CO., LTD., contains notes on "Flotation Plant Control" as well as some interesting figures about the expansion of the Aluminium Co. of America. Among the developments undertaken by the company at Alcoa, Tennessee, is the building of a roof to cover an area of 50 acres.

Personal Notes

MR. GEOFFREY HART has been elected a director of Lacrinoid Products, Ltd., plastic goods manufacturers.

MR. JOHN WILLIAM TOWERS, of Wavertree and Widnes, chemical laboratory furnisher, left £30,417 gross, with net personality £27,533 (estate duty £3,907).

DR. C. J. T. CRONSHAW, D.Sc., F.I.C., M.I.Chem.E., F.T.I., F.R.S.E., has been re-elected president of the Society of Dyers and Colourists. The other officers were also re-elected.

DR. S. S. PICKLES, D.Sc., F.I.C., and DR. D. F. TWISS, D.Sc., F.I.C., were elected vice-presidents of the Institution of the Rubber Industry at the 19th annual meeting held on June 11.

MR. J. PARAVICINI, J.P., principal of Turners Asbestos Cement Co., Ltd., has been elected vice-chairman of the National Joint Industrial Council of the asbestos manufacturing industry.

MR. P. C. HOLMES HUNT, Director of Substitute Fuels to the Commonwealth Government of Australia, has been appointed to represent public interests on the Board of National Oil Pty. Ltd., the company which is developing the oil shale deposits at Glen Davis, New South Wales.

Among the members of the committee set up by the Minister of Health to consider the position of vegetable drugs are DR. W. P. KENNEDY, Ph.D., L.R.C.P. & S., F.I.C. (Ministry of Health); DR. H. A. TEMPANY, C.B.E., D.Sc., F.I.C. (Colonial Office); and MR. T. E. WALLIS, B.Sc., F.I.C., F.L.S. (University of London).

MR. WALTER CHARLES DEVEREUX has been appointed Controller of North American Aircraft Supply to the Ministry of Aircraft Production. Mr. Devereux is chairman of International Alloys, Ltd., and managing director of High Duty Alloys, Ltd., among other companies, and has had over 25 years' experience of light alloy constructional work.

At the annual meeting of the Association of British Insecticide Manufacturers on May 28, officers and executive committee for the year 1941-42 were elected as follows:—Chairman, MR. H. J. JONES (Hemingway and Co., Ltd.); vice-chairman, MR. F. H. HALL (Buggés Insecticides, Ltd.); honorary treasurer, MR. E. Z. BOLT (G. H. Richards, Ltd.); honorary auditor, MR. R. A. BLAIR (Burt, Boulton and Haywood, Ltd.); executive committee, MR. R. A. BLAIR, MR. R. V. CRAVEN (W. J. Craven & Co., Ltd.), MR. F. H. HALL, DR. E. HOLMES (I.C.I., Ltd.), MR. J. S. MITCHELL (Murphy Chemical Co., Ltd.), and DR. J. H. REID (British Nicotine Co., Ltd.). The secretary is MR. J. DAVIDSON PRATT, 166 Piccadilly, London, W.1.

OBITUARY

DR. Y. MAGAZANIK, who died recently at the age of 55, was director of the Chemical Laboratory at the Daniel Sieff Research Institute, Rehoboth, Palestine.

MR. ARTHUR ISAAC BARLOW, who died on June 16, aged 77, at Eccles, Lancs, was a director of Isaac Bentley and Co., Ltd., Trafford Park, oil manufacturers.

MAJOR DAVID BARNETT, who was killed in action in Crete on May 20, was a director of J. Dampney and Co., Ltd., and Hoyle, Robson, Barnett and Co., Ltd., both firms being paint manufacturers.

MAJOR LOTHIAN WILSON, B.Sc., whose death took place on June 16 at Nayland, Suffolk, as a result of enemy action last September, was a director of Thomas S. Jackson and Sons, paint and varnish manufacturers, Mitcham. He had been with the firm for seven years and occupied the position of works manager and chemist. Before that he had been works

manager in South Africa, and had served with Messrs. Senner and Alder, Millwall. Throughout the last war he served with the Royal Army Service Corps and was one of the first of the B.E.F. to land in France.

New Control Orders

Chlorates

THE Minister of Supply has made the Control of Chlorates (No. 1) Order controlling purchases and sales of chlorates (salts of chloric acid) and all substances containing not less than 10 per cent. by weight of free chlorate. As from June 14 sales of the controlled material must not be made unless the seller holds a licence authorising him to dispose of the material or unless the sale is made to a person who holds a licence authorising him to acquire the material.

Inquiries should be addressed to: The Chlorates Control, Ministry of Supply, Raw Materials Department, Warwick. Copies of the Order (S.R. and O. No. 827, 1941) can be obtained from H.M. Stationery Office, or any bookseller (1d.).

Vitamin A Manufacture

The Minister of Food has made an Order (S.R. and O. No. 810, 1941) which comes into force on June 23, prohibiting, except under licence, the manufacture or use of vitamin A. The Order does not apply to the manufacture or use of vitamin A for medicinal or scientific purposes.

Phosphates for Steel-Cleaning

Widespread Use Forecast

WHETHER the ideal alkali cleaner for steel that is to be nickel-plated has yet been found is a moot point, but the trend of cleaning development has been in the direction of using one or more of a number of detergent chemicals, the alkalinity of which is in the main weak. In a paper, presented recently to the Electrodepositors' Technical Society, Dr. S. Wernick notes that phosphates, either alone or in conjunction with silicates, are being favoured by plating chemists, and it is probable that their use will become widespread in time. Tri-sodium phosphate, in particular, is a popular cleaning chemical which possesses valuable detergent properties, particularly if operated electrolytically. It is a mild alkali which can be used for such attackable metals as zinc and aluminium. One aspect of cleaning practice often forgotten is the hardness of the water supply. Alkali cleaners occasion the formation of precipitates with hard water, the degree of which depends on the hardness of the water and the amount of work passing through the plant. Even in moderately worked plant, heavy precipitates are partially carried over on the work, and have been found to adhere to the surface just prior to entering the plating bath. These particles may well be the initial cause of such plating defects as blistering and roughness, for even if removed before the actual plating operation, the particles will have screened the surface locally during important phases of the preparatory treatment and so may become the site of a local defect. Hard water can readily be dealt with, the simplest method consisting of the addition of a chemical which will inhibit the formation of the precipitate by suspending it in such a fine condition that no local precipitation on the metal surface occurs. Substances such as sodium hexametaphosphate or mono-sodium orthophosphate (NaH_2PO_4) or acid sodium pyrophosphate ($\text{Na}_2\text{H}_2\text{P}_2\text{O}_7$) have been found to be effective in different degrees for the purpose. So far as the author is aware, the use of this method of preventing undesirable precipitation has not previously been practised in metal-cleaning work.

FOUR OUT OF FIVE of the industrial alcohol distilleries in Eire are stated to have been closed down as they are dependent either on potatoes, needed for human consumption, or on molasses, which is fed to cattle. The only remaining plant is operated in the "black seab" area where potatoes are unsuitable as food.

General News

THE FOLLOWING SUBSTANCES should be added to the list of simple drugs, etc., on pages 31 to 33 of Customs and Excise Notice 78, which are not chargeable with Purchase Tax, unless put up for medicinal or veterinary use: benzyl cinnamate, chlorocresol (B.P. Third Addendum).

TO ENCOURAGE THE PREPARATION of papers by students of fuel technology, the Council of the Institute of Fuel has decided to make an annual award of a medal, together with a prize consisting of books and instruments to the value of £5. The prize may consist of instruments alone.

THE TRADING WITH THE ENEMY (Specified Persons) (Amendment) (No. 8) Order, 1941, contains a number of additions and a few deletions from the previous list of persons and firms in neutral countries with whom trading is illegal. Those of possible chemical interest are: Drogueria Albrecht, Calle Colon 402, and Drogueria Hamburgo, Calle Socabaya 126, Casilla 262, both of La Paz, Bolivia; Drogueria Hammer, San Pedro Sula, Honduras; Drogueria Oscar Ruiz, Rotalde, Lima, Peru; and Laboratorio Meyer C.A., Apartado 487, Caracas, Venezuela. Among the deletions is the-Gesellschaft für Metallo-Chemische Interessen, Bahnhofstrasse 5, Zurich.

Foreign News

THE CANADIAN GOVERNMENT is investigating the extent of tungsten ore deposits discovered recently at Gilmore Lake. They have already assayed 57.61 per cent.

NYLON FIBRE, it is reported, has been successfully adopted in the United States for the manufacture of a new type of brush for the porcelain enamel industry.

BESIDES CASTOR OIL which is needed for aircraft engines, German purchasing agents are buying cotton and oilseeds on a large scale, Reuter reports from Shanghai.

REUTER REPORTS FROM NEW YORK that Du Pont de Nemours have reduced the price of various deniers and nylon yarn by 10 to 30 cents. per lb.

REPORTS FROM AMERICA SUGGEST THAT a Government monopoly is likely to be established to handle imports and allocation of "strategic raw materials," such as rubber, tin, tungsten, antimony, manganese and bauxite.

IMPORTS OF CAUSTIC SODA into Paraguay in 1940 amounted to 588 metric tons, valued at 52,507 gold pesos, the smallest for 3 years. Imports in 1939 were 775 tons and in 1938, 665 tons.

THE CONSTRUCTION OF A WELDED STEEL PIPELINE, to convey natural gas from the West Virginia gas-field area to the glass works at Lancaster, Ohio, is proposed by the Anchor-Hocking Glass Corporation.

THE SHARE CAPITAL of Norsk Hydro is to be increased by 52,000,000 crowns (£3,000,000) in preparation for the construction of a series of new factories to serve German war purposes, says the Norwegian Telegraph Agency.

TWO INDIAN FIRMS have started investigations for the manufacture of margarine for British troops. This was suggested by the Board of Scientific and Industrial Research, which also set up an exploratory committee for surveying the existing position of essential oils.

MR. ICKES, THE UNITED STATES DEFENCE PETROLEUM CO-ORDINATOR, has stopped the shipment of 252,000 gallons of petrol for Japan on the grounds that it is needed on the east coast. It is believed that he is also contemplating a general ban on oil exports from the Atlantic seaboard in view of the threatened shortage.

BY ORDER OF THE SPANISH MINISTRY of Industry and Commerce, glycerine is now to be obtained from green sulphur oil in Spain. About half the estimated production of sulphur oil for 1941—approximately 15 million kg.—will be reserved for the purpose, and the National Syndicate of Chemical Industries is responsible for the erection of the requisite plant.

BRAZILIAN STEEL OUTPUT in 1940 amounted to 141,000 tons (metric), compared with 114,100 in 1939; pig iron also increased from 160,000 tons to 185,300, and rolled goods from 101,000 tons to 135,300. Over 22,000 tons of pig iron were exported in 1940, mainly to the Argentine Republic. A new steel plant is to be erected at Volta Redonda, Rio de Janeiro.

From Week to Week

THE DOMESTIC PRODUCTION of molybdenum in the United States during 1940 amounted to 28,651 short tons of concentrates containing 29,705,000 pounds of metallic molybdenum, as compared with 32,347 tons of concentrates containing 30,324,000 pounds of metallic molybdenum in 1939. These figures are from an advance summary issued by the Bureau of Mines.

EXPORTS FROM SOUTHERN RHODESIA in 1940 were valued at £15,010,188 as compared with £11,795,152 in 1939. Gold, asbestos, chrome ore, some other minerals, and raw tobacco account for 90 per cent. of the value of the domestic exports. A much larger market in Canada and the United States than usual was found for chrome ore and asbestos, and the combined value of the purchases by the dollar countries represented 6.7 per cent. of the total exports as compared with 2.6 per cent. in 1939.

Forthcoming Events

AN INFORMAL DINNER of the Institution of Factory Managers will be held at the Hotel Russell, Russell Square, London, W.C.1, at 6.30 p.m., on June 21. The cost will be 11s. 6d., exclusive of wines. At the dinner a presentation will be made to Mr. J. Gordon Miller, B.Sc., A.M.Inst.C.E., in recognition of his valuable services to the Institution as first Chairman of the Council, from 1938 to 1941. Mr. Gordon Miller has stipulated that the bulk of the amount collected shall be spent on a rifle, to enable members of his Home Guard unit to obtain shooting practice.

THE SCIENTIFIC AND TECHNICAL GROUP of the Royal Photographic Society is holding a meeting on June 24, at 5 p.m., at 16 Princes Gate, S.W.7, when Messrs. W. F. Berg, A. Marriage and G. W. W. Stevens will speak on "Latent Image Distribution."

Pigments for Protective Paints

New Process for Particle-Shape Control

FOR several years past it has been appreciated that the advantageous properties of aluminium paints, particularly in respect of durability, protection of underlying metal against corrosion, and reflection of light and heat, are due largely to the flake-like form of the pigment particles and their ability to leaf in the vehicle employed. This has led to experiments, mostly unsuccessful, on the production of other pigments with this desirable combination of properties.

It is now claimed (B.P. Appl. 6444/1941) that practically any pigment can be manufactured in the form of flakes by a recently patented process. In addition to controlling the shape of the pigment particles, this patent also claims that leafing properties may be conferred on the pigment flakes at will by a suitable modification of their surface. The possession of leafing properties causes the pigment flakes to tend to float to the surface and, especially at the paint-air or lacquer-air interface, to arrange themselves in planes parallel to the surface of the paint film.

This combination of properties has great beneficial effects on the paint film, improving especially its resistance to the penetration of moisture and to corrosive influences. In view of the well-known advantages associated with a leaf or flake-like form of pigment particles in paint films, the value of a process which enables any pigment to be obtained in this form is obvious. Paints made up with these new pigments should undoubtedly constitute a most welcome and possibly superior alternative to aluminium paints, especially now, when the use of aluminium is greatly restricted under Government regulations.

Weekly Prices of British Chemical Products

THE market in general chemicals has been maintained along fairly steady lines during the past week and no price changes in any section fall to be noted. The volume of business transacted has been of moderate dimensions, whilst contract deliveries have been absorbed at a steady rate. Acetic, tartaric and citric acids are enjoying a good demand and items such as formaldehyde and acetone are in good request. Amongst the soda products there is a good demand for yellow prussiate, bichromate and chlorate of soda and in the potash section the volume of trade continues to be regulated by the supply position. Throughout the market prices are firm and steady at recent levels. There has been a fair amount of activity in most sections of the coal tar products market and values in all directions are on a firm basis, cresylic acid being particularly strong. Crude carbolic acid continues in good request and a firm tendency for xylol is again noted.

MANCHESTER.—Fairly satisfactory trading conditions have been reported on the Manchester chemical market during the past week and a generally firm undertone continues. Contract deliveries of a wide range of textile chemicals are on steady lines, both to Lan-

cashire and Yorkshire consumers, and good supplies are being called for by most of the other using trades. New inquiry from domestic users during the week has been on a fair scale, whilst export buying interest has been moderate. Marked firmness continues to be a feature of the tar products section and the demand for most varieties is active.

GLASGOW.—Business in the Scottish heavy chemical trade still maintains the steady day to day transactions. Inquiries for export are rather quiet again. Prices keep exceptionally firm, but where any changes occur they are higher.

Price Changes

Rises: Carbolic acid, cresylic acid, copper sulphate, potassium bichromate, potassium chlorate, pyridine, sodium chlorate, sodium nitrite, xylol.

General Chemicals

Acetic Acid.—Maximum prices per ton: 80% technical, 1 ton £39 10s.; 10 cwt./1 ton, £40 10s.; 4/10 cwt., £41 10s.; 80% pure, 1 ton, £41 10s.; 10 cwt./1 ton, £42 10s.; 4/10 cwt., £43 10s.; commercial glacial, 1 ton, £49; 10 cwt./1 ton, £50; 4/10 cwt., £51; delivered buyers' premises in returnable barrels, £4 10s. per ton extra if packed and delivered in glass.

Acetone.—Maximum prices per ton: 50 tons and over, £65; 10/50 tons, £65 10s.; 5/10 tons, £66; 1/5 tons, £66 10s.; single drums, £67 10s.; delivered buyers' premises in returnable drums or other containers having a capacity of not less than 45 gallons each. For delivery in non-returnable containers of 40/50 gallons, the maximum prices are £3 per ton higher. Deliveries of less than 10 gallons free from price control.

Alum.—Loose lump, £9 10s. per ton, d/d, nominal.

Aluminium Sulphate.—£8 to £8 10s. per ton d/d.

Ammonia Anhydrous.—1s. 7d. to 2s. 2d. per lb.

Ammonium Carbonate.—£39 to £40 per ton d/d in 5 cwt. casks.

Ammonium Chloride.—Grey galvanising, £22 10s. per ton, in casks, ex wharf. Fine white 98%, £19 10s. per ton. MANCHESTER: Grey galvanising, £22 10s. per ton. See also Salammoniac.

Antimony Oxide.—£68 per ton.

Arsenic.—99/100%, about £31 10s. per ton, ex store.

Barium Chloride.—98/100%, prime white crystals, £11 10s. to £13 per ton, bag packing, ex works; imported material would be dearer.

Bleaching Powder.—Spot, 35/37%, £10 7s. 6d. per ton in casks, special terms for contract.

Borax, Commercial.—Granulated, £26; crystals, £27; powdered, £27 10s.; extra fine powder, £28 10s.; B.P. crystals, £35; powdered, £35 10s.; extra fine, £36 10s. per ton for ton lots, in free 1-cwt. bags, carriage paid in Great Britain. Borax Glass, lump, £73; powder, £74 per ton in tin-lined cases for home trade only, packages free, carriage paid.

Boric Acid.—Commercial, granulated, £42 10s.; crystals, £43 10s.; powdered, £44 10s.; extra fine powder, £46 10s.; large flakes, £55; B.P. crystals, £51 10s.; powdered, £52 10s.; extra fine powdered, £54 10s. per ton for ton lots in free 1-cwt. bags, carriage paid in Great Britain.

Calcium Bisulphite.—£6 10s. to £7 10s. per ton f.o.r. London.

Calcium Chloride.—70/72% solid, £5 15s. per ton ex store.

Charcoal Lump.—£10 10s. to £14 per ton, ex wharf. Granulated, supplies scarce.

Chlorine, Liquid.—£21 7s. 6d. per ton, d/d in 16/17 cwt. drums (3-drum lots); 5½d. per lb. d/d station in single 70-lb. cylinders.

Chrometan.—Crystals, 5½d. per lb.; liquor, £23 per ton d/d station in drums.

Chromic Acid.—1s. 2d. per lb., less 2½%; d/d U.K. GLASGOW: 1s. 0½d. per lb. for 1 cwt. lots.

Citric Acid.—1s. 2d. per lb. MANCHESTER: 1s. 6d.

Copper Sulphate.—About £29 10s. per ton f.o.b. MANCHESTER: £29 10s., less 2%, in 5 cwt. casks f.o.b. Liverpool.

Cream of Tartar.—100%, 25s. per cwt., less 2½%, d/d in sellers' returnable casks.

Formaldehyde.—£21 15s. to £25 per ton d/d. MANCHESTER: 40%, £22 to £25 per ton in casks d/d; imported material dearer.

Formic Acid.—85%, £47 per ton for ton lots, carriage paid, carboys returnable; smaller parcels quoted up to 50s. per cwt., ex store.

Glycerine.—Chemically pure, double distilled 1260 s.g., in tins, £3 15s. to £4 15s. per cwt., according to quantity; in drums, £3 7s. 6d. to £4 1s. Refined pale straw industrial, 5s. per cwt., less than chemically pure.

Hexamine.—Technical grade for commercial purposes, about 1s. 4d. per lb.; free-running crystals are quoted at 2s. 1d. to 2s. 3d. per lb.; carriage paid for bulk lots.

Hydrochloric Acid.—Spot, 6s. 3½d. to 8s. 9½d. carboy d/d, according to purity, strength and locality.

Iodine.—Resublimed B.P., 9s. 11d. to 13s. 11d. per lb., according to quantity.

Lactic Acid.—Dark tech., 50% by vol., £31 per ton; 50% by weight, £38; 80% by weight, £67; pale tech., 50% by vol., £39 10s.; 50% by weight, £46, 80% by weight, £74. Not less than one ton lots ex works; barrels returnable, carriage paid.

Lead Acetate.—White, £46 10s. to £48 10s. ton lots. MANCHESTER: £46 to £48 per ton.

Lead Nitrate.—About £45 10s. per ton d/d in casks.

Lead Red.—English, 5/10 cwt., £43 10s.; 1 cwt. to 1 ton, £43 5s.; 1/2 tons, £43; 2/5 tons, £42 10s.; 5/20 tons, £42; 20/100 tons, £41 10s.; over 100 tons, £41 per ton, less 2½ per cent., carriage paid; non-setting red lead 10s. per ton dearer in each case.

Lead White.—Dry English, less than 5 tons, £55; 5/15 tons, £51; 15/25 tons, £50 10s.; 25/50 tons, £50; 50/200 tons, £49 10s. per ton, less 5 per cent., carriage paid; Continental material, £1 per ton cheaper. Ground in oil, English, 1/5 cwt., £63 10s.; 5/10 cwt., £62 10s.; 10 cwt. to 1 ton, £62; 1/2 tons, £60 10s.; 2/5 tons, £59 10s.; 5/10 tons, £57 10s.; 10/15 tons, £56 10s.; 15/25 tons, £56; 25/50 tons, £55 10s.; 50/100 tons, £55 per ton, less 5 per cent., carriage paid.

Litharge.—1 to 2 tons, £41 10s. per ton.

Lithium Carbonate.—7s. 9d. per lb. net.

Magnesite.—Calcined, in bags, ex works, £14 to £17 per ton.

Magnesium Chloride.—Solid (ex wharf), £12 to £13 per ton. MANCHESTER: £13 to £14 per ton.

Magnesium Sulphate.—Commercial, £10 to £12 per ton, according to quality, ex works.

Mercury Products.—Controlled price for 1 cwt. quantities: Bichloride powder, 11s. 7d.; bichloride lump, 12s. 2d.; ammon. chloride powder, 13s. 5d.; ammon. chloride lump, 14s.; mercurous chloride, 13s. 9d.; mercury oxide, red crvst., B.P., 15s.; red levig. B.P., 15s. 6d.; yellow levig. B.P., 14s. 9d.; yellow red, 14s. 4d.; sulphide, red, 12s. 11d.

Methylated Spirit.—Industrial 66° O.P. 100 gals., 2s. 0½d. per gal.; pyridinised 64° O.P. 100 gals., 2s. 5d. per gal.

Nitric Acid.—£23 to £31 per ton ex works.

Oxalic Acid.—From £60 per ton for ton lots, carriage paid, in 5-cwt. casks; smaller parcels would be dearer; deliveries slow.

Paraffin Wax.—Nominal.

Potash, Caustic.—Basic price for 50-100 ton lots. Solid, 88/92%, commercial grade, £53 15s. per ton, c.i.f. U.K. port, duty paid. Broken, £5 extra; flake, £7 10s. extra; powder, £10 extra per ton. Ex store, £3 10s. supplement.

Potassium Bichromate.—Crystals and granular 8d. per lb.; ground 7d. per lb., carriage paid. MANCHESTER and GLASGOW: 7d. per lb. in orig. casks.

Potassium Carbonate.—Basic prices for 50 to 100 ton lots; hydrated, 83/85%, £46 17s. 6d. per ton; calcined, 98/100%, £52 10s. per ton, c.i.f. U.K. port. Ex warehouse, £3 10s. extra per ton.

Potassium Chlorate.—Imported powder and crystals, ex store London, 2s. per lb.

Potassium Iodide.—R.P., 8s. 8d. to 12s. per lb., according to quantity.

Potassium Nitrate.—Small granular crystals, £26 to £30 per ton ex store, according to quantity.

Potassium Permanganate.—B.P., 1s. 5½d. per lb. for 1 cwt. lots; commercial, £7 9s. 6d. to £8 1s. 6d. per cwt., according to quantity d/d.

Potassium Prussiate.—Yellow, about 1s. 3d. to 1s. 5d. per lb., supplies scarce.

Salammoniac.—First lump, spot, £48 per ton; dog-tooth crystals, £50 per ton; medium, £48 10s. per ton; fine white crystals, £19 10s. per ton, in casks, ex store.

Soda, Caustic.—Solid, 76/77% spot, £14 17s. 6d. per ton d/d station.

Soda Crystals.—Spot, £5 to £5 5s. per ton d/d station or ex depot in 2-cwt. bags.

Sodium Acetate.—£40 per ton, ex wharf.

Sodium Bicarbonate (refined).—Spot, £11 per ton, in bags.

Sodium Bichromate.—Crystals, cake and powder, 5½d. per lb., anhydrous, 6d. per lb. net d/d U.K. MANCHESTER AND GLASGOW: 5½d. per lb., in orig. casks.

Sodium Bisulphite Powder.—60/62%, £17 10s. per ton d/d in 2-ton lots for home trade.

Sodium Carbonate Monohydrate.—£21 per ton d/d in minimum ton lots in 2 cwt. free bags.

Sodium Chlorate.—£36 to £40 per ton, d/d, according to quantity.

Sodium Hyposulphite.—Pea crystals, £19 15s. per ton for 2-ton lots; commercial, £14 10s. per ton. MANCHESTER: Commercial, £14 10s.; photographic, £19 15s.

Sodium Iodide.—B.P., for not less than 28 lb., 9s. 6d. per lb.; for not less than 7 lb., 13s. 1d. per lb.

Sodium Metasilicate.—£14 5s. per ton, d/d U.K. in cwt. bags.

Sodium Nitrate.—Refined, £13 10s. per ton for 2-ton lots d/d.

Sodium Nitrite.—£24 per ton for ton lots.

Sodium Perborate.—10%, £5 2s. per cwt.

Sodium Phosphate.—Di-sodium, £19 to £22 per ton d/d for ton lots. Tri-sodium, £25 to £27 per ton d/d for ton lots.

Sodium Prussiate.—From 7½d. per lb. ex store.

Sodium Silicate.—£8 17s. 6d. to £9 10s. per ton, for 4-ton lots.

Sodium Sulphate (Glauber Salts).—£4 10s. per ton d/d.

Sodium Sulphate (Salt Cake).—Unground. Spot £4 13s. 6d. per ton d/d station in bulk. MANCHESTER: £4 13s. 6d. per ton d/d station.

Sodium Sulphide.—Solid 60/62%, Spot, £17 5s. per ton d/d in drums; crystals, 30/32%, £12 12s. per ton d/d in casks.

Sodium Sulphite.—Anhydrous, £29 10s. per ton; Pea crystals, spot, £18 10s. per ton d/d station in kegs; commercial, £12 15s. per ton d/d station in bags.

Sulphur.—Finely powdered, £18 10s. per ton d/d; precip. B.P., 68s. per cwt.

Sulphuric Acid.—168° Tw., £6 10s. to £7 10s. per ton; 140° Tw., arsenic-free, £4 11s. per ton; 140° Tw., arsenious, £4 3s. 6d. per ton. Quotations naked at sellers' works.

Tartaric Acid.—3s. 0½d. per lb., less 5%, carriage paid for lots of 5 cwt. and upwards. MANCHESTER: 3s. 0½d. per lb.

Zinc Oxide.—Maximum prices: White seal, £30 17s. 6d. per ton; red seal, £28 7s. 6d. d/d; green seal, £29 17s. 6d. d/d buyers' premises.

Zinc Sulphate.—Tech., about £25, carriage paid, casks free.

Rubber Chemicals

Antimony Sulphide.—Golden, 10d. to 1s. 10d. per lb. Crimson, 1s. 8½d. to 2s. per lb.

Arsenic Sulphide.—Yellow, 1s. 9d. per lb.

Barytes.—Best white bleached, £8 3s. 6d. per ton.

Cadmium Sulphide.—5s. 6d. to 6s. 6d. per lb.

Carbon Black.—5½d. to 8½d. per lb., according to packing.

Carbon Bisulphide.—£33 5s. to £38 5s. per ton, according to quantity, in free returnable drums.

Carbon Tetrachloride.—£46 to £49 per ton.

Chromium Oxide.—Green, 1s. 6d. per lb.

India-rubber Substitutes.—White, 5 15/16d. to 8½d. per lb.; dark, 5 9/16d. to 8½d. per lb.

Lithopone.—30%, £25 per ton; 60%, £31 to £32 per ton. Imported material would be dearer.

Mineral Black.—£10 to £14 per ton.

Mineral Rubber, "Rupron."—£20 per ton.

Sulphur Chloride.—7d. per lb.

Vegetable Lamp Black.—£45 per ton.

Vermilion.—Pale or deep, 13s. 8d. per lb., for 7 lb. lots and less. Plus 5% War Charge.

Nitrogen Fertilisers

Ammonium Phosphate Fertilisers.—Type A, £21 8s.; B, £15 5s. 6d., C, £18 17s. per ton in 6-ton lots, d/d farmer's nearest station up to June 30, 1941.

Ammonium Sulphate.—Per ton in 6-ton lots, d/d farmer's nearest station: March/June, £10 2s.

Calcium Cyanamide.—Nominal; supplies very scanty.

Concentrated Complete Fertilisers.—£15 10s. to £16 3s. 6d. per ton in 6-ton lots, d/d farmer's nearest station up to June 30, 1941. Supplies small except C.C.F. Special at £15 14s. per ton.

"Nitro-Chalk."—£9 14s. per ton in 6-ton lots, d/d farmer's nearest station up to June 30, 1941.

Sodium Nitrate.—Chilean, £13 10s. per ton in 2-ton lots, f.o.r. Liverpool, June delivery; agricultural, £10 14s. per ton in 2-cwt. bags, d/d farmer's nearest station up to June 30, 1941.

Coal Tar Products

Benzol.—Industrial (containing less than 2% of toluol), 2s. to 2s. 2d. per gal., ex works.

Carbolic Acid.—Crystals, 9½d. to 10½d. per lb.; Crude, 60's 3s. 3d. to 4s. 3d., according to specification. MANCHESTER: Crystals, 10½d. per lb., d/d; crude, 3s. 8d. to 3s. 11d. naked at works.

Creosote.—Home trade, 5½d. to 5½d. per gal., f.o.r., maker's works; exports 6d. to 6½d. per gal., according to grade. MANCHESTER: 5½d. to 7½d. per gal.

Cresylic Acid.—Pale, 99/100%, 3s. to 3s. 6d. per gal. MANCHESTER: Pale, 99/100%, 3s. 2d. per gal.

Naphtha.—Solvent, 90/160°, 2s. 4d. to 2s. 7d. per gal.; Heavy 90/190°, 1s. 8d. to 1s. 9d., naked at works. MANCHESTER: 90/160°, 2s. 4d. to 2s. 7d.

Naphthalene.—Crude, whizzed or hot pressed, £14 per ton; purified crystals, £27 per ton in 2-cwt. bags; flaked, £27 per ton. Fire-lighter quality, £6 to £7 per ton ex works. MANCHESTER: Refined, £27 per ton.

Pitch.—Medium, soft, nominal, f.o.b. MANCHESTER: Nominal.

Pyridine.—90/140°, 17s. 6d. per gal.; 90/160°, 13s. 6d.; 90/180°, 1s. to 5s. per gal., f.o.b. MANCHESTER: 13s. 6d. to 18s. per gal.

Toluol.—Pure, 2s. 5d., nominal. MANCHESTER: Pure, 2s. 5d. per gal., naked.

Xylol.—Commercial, 3s. 7d. per gal.; pure, 3s. 9d. MANCHESTER: 3s. 4d. to 3s. 9d. per gal.

Wood Distillation Products

Calcium Acetate.—Brown, £21 per ton; grey, £24. MANCHESTER: Grey, £23.

Methyl Acetone.—40.50%, £54 per ton.

Wood Creosote.—Unrefined, 2s. per gal., according to boiling range.

Wood Naphtha, Miscible.—4s. 6d. to 5s. per gal.; solvent, 5s. per gal.

Wood Tar.—£4 to £5 per ton, according to quality.

Intermediates and Dyes (Prices Nominal)

m-Cresol 98/100%.—Nominal.

o-Cresol 30/31° C.—Nominal.

p-Cresol 34/35° C.—Nominal.

Dichloraniline.—2s. 8½d. per lb.

Dinitrobenzene.—8½d. per lb.

Dinitrotoluene.—48/50° C., 9½d. per lb.; 66/68° C., 1s.

p-Nitraniline.—2s. 5d. per lb.

Nitrobenzene.—Spot, 5½d. per lb., in 90-gal. drums, drums extra. 1-ton lots d/d buyer's works.

Nitronaphthalene.—1s. 2d. per lb.; P.G., 1s. 0½d. per lb.

o-Toluidine.—1s. per lb., in 8/10 cwt. drums, drums extra.

p-Toluidine.—2s. 2d. per lb., in casks.

m-Xylidine Acetate.—4s. 5d. per lb., 100%.

Latest Oil Prices

LONDON.—June 19.—For the period ending June 28, per ton, net, naked, ex mill, works or refinery, and subject to additional charges according to package and location of supplies:—
 LANSSED OIL, raw, £41 10s. RAPESEED OIL, crude, £44 5s. COTTONSEED OIL, crude, £31 2s. 6d.; washed, £34 5s.; refined edible, £35 12s. 6d.; refined deodorised, £36 10s. SOYA BEAN OIL, crude, £33; refined deodorised, £37. COCONUT OIL, crude, £28 2s. 6d.; refined deodorised, £31 7s. 6d. PALM KERNEL OIL, crude, £27 10s.; refined deodorised, £30 15s. PALM OIL, refined deodorised, £37; refined hardened deodorised, £41. GROUNDNUT OIL, crude, £35 10s.; refined deodorised, £40. WHALE OIL, crude hardened, 42 deg., £30 10s.; refined hardened, 42 deg., £33. ACID OILS.—Groundnut, £19; soya, £17; coconut and palm kernel, £22 10s. ROSIN, 25s. to 30s. per cwt., ex wharf, according to grade. TURPENTINE, 68s. 6d. per cwt. spot, American, including tax, ex wharf, in barrels, and ex discount.

LIVERPOOL.—June 18.—TURPENTINE, spot, American, 68s. 6d. per cwt.

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Inventions in the Chemical Industry

The following information is prepared from the Official Patents Journal. Printed copies of Specifications accepted may be obtained from the Patent Office, 25 Southampton Buildings, London, W.C.2, at 1s. each. The numbers given under "Applications for Patents" are for reference in all correspondence up to the acceptance of the Complete Specification.

Applications for Patents

CENTRIFUGAL SEPARATORS.—A/B Separator. (Sweden, June 3, '40.) 6236.
 AZO DYESTUFFS.—American Cyanamid Co. (United States, July 10, '40.) 6135.
 MANUFACTURE OF OIL-SOLUBLE RESINS.—Bakelite, Ltd. (United States, May 15, '40.) 6140.
 IMPREGNATION OF WOOD WITH RESIN.—Bakelite, Ltd. (United States, May 14, '40.) 6187.
 PREPARATIONS OF ROSIN EMULSIONS.—F. G. L. Becker. 6143.
 TREATMENT OF TEXTILE FABRICS.—British Celanese, Ltd. (United States, May 10, '40.) 6076.
 HYDROLYTIC DECOMPOSITION OF TITANIUM SALT SOLUTIONS.—British Titan Products Co., Ltd. (United States, June 18, '40.) 6001.
 HEAT-EXCHANGE DEVICES.—J. L. Coltman and Imperial Chemical Industries, Ltd. 6201.
 TREATMENT OF CELLULOSIC TEXTILE MATERIALS.—Courtaulds, Ltd., and J. H. MacGregor. 5975.
 METHOD OF PREPARING SUBSTANCES having vitamin-A activity.—Distillation Products, Inc. (United States, April 9.) 6067.
 CELLULOSE ESTERS.—Distillers Co., Ltd., H. P. Standinger, and H. M. Hutchinson. 6246.
 PRODUCTION OF ORGANIC COMPOUNDS.—H. Dreyfus. 6074, 6075.
 STABILISATION OF ORGANIC SUBSTANCES.—E. I. du Pont de Nemours and Co., and M. A. Dietrich. 6029.
 MANUFACTURE OF SODIUM PERBORATE.—E. I. du Pont de Nemours and Co. and H. N. Gilbert. 6101.
 MANUFACTURE OF SODIUM MONOXIDE.—E. I. du Pont de Nemours and Co., and H. N. Gilbert. 6102.
 PRODUCTION OF PURIFIED CORTICOTROPHIC HORMONE.—F. Hartley. 6087.
 MANUFACTURE OF ADHESIVES.—E. S. Hole. 6159.
 PREPARATION OF ANTISEPTIC ANALGESIC BASE for manufacture of soap.—T. D. Kelly. 6131.
 METAL-EXTRUSION PRESSES, and methods of operating same.—L. Loewy. 6019.
 METAL-WORKING PRESSES.—L. Loewy. 6020.
 MOTH-PROOFING WOOLLEN MATERIALS.—A. McLean, D. Traill, and Imperial Chemical Industries, Ltd. 6202.
 MAGNETIC PURIFICATION OF FLUIDS.—Magnetos Lucifer Soc. Anon. (Switzerland, Sept. 10, '40.) 6180.
 PRODUCTION OF STEEL CASTINGS.—Mond Nickel Co., Ltd. (Canada, May 16, '40.) 6056.
 TREATMENT OF FAT-SOLUBLE VITAMIN-CONTAINING OILS.—National Oil Products Co. (United States, July 2, '40.) 6211.
 GLASS SUBSTITUTE.—North British Rubber Co., Ltd., and A. Johnston. 6225.
 PROCESS AND APPARATUS FOR PRODUCTION OF HYDROCARBONS.—H. E. Potts (N. V. Internationale Koolwaterstoffen Synthese Mij. (International Hydrocarbon Synthesis Co.)) 6109.
 TREATMENT OF GASES.—R. Quarendon, W. O. Jones, and Imperial Chemical Industries, Ltd. 6030.
 REFINING OF OILS, ETC.—Refiners, Ltd., and T. Scott. 6223.
 MANUFACTURE OF KETO-ALCOHOL ACETATES.—Roche Products, Ltd., and F. Bergel. 6192.
 PREPARATION OF TERPENE and rosin-modified phenol-ketone-formaldehyde resin.—I. Rosenblum. 6137.
 DESTRUCTION OF WEEDS.—W. A. Sexton, W. G. Templeman, and Imperial Chemical Industries, Ltd. 6103.
 MANUFACTURE OF ANHYDROUS MAGNESIUM CHLORIDE.—K. Strauss and Foundry Services, Ltd. 5984.
 DEVICE FOR DELIVERING MIXTURES OF FLUIDS with solids suspended therein.—D. Taylor. 6069.
 METHOD AND APPARATUS FOR EXTRACTION OF SUBSTANCES FROM LIQUID MEDIUMS.—W. W. Triggs (U.S. Vitamin Corporation). 6127.
 TREATMENT OF TEXTILE MATERIALS.—United Turkey Red Co., Ltd., and H. Raudnitz. 6220, 6221, 6222.
 RUBBER HYDROCHLORIDE.—Wingfoot Corporation. (United States, Aug. 29, '40.) 6178.
 MANUFACTURE OF ACRYLONITRILES.—Wingfoot Corporation. (United States, Oct. 9, '40.) 6179.
 PROCESSES AND MATERIALS FOR THICKENING LATEX, ETC.—Advance Solvents and Chemical Corporation. (United States, July 16, '40.) 7081.
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 METHOD OF EFFECTING CATALYTIC REACTIONS.—Standard Oil Development Co. Oct. 31, 1939. 15643/40.
 BASIC DYESTUFF PREPARATIONS, and their application in printing animal and vegetable fibres.—Durand and Huguenin A.-G. Nov. 8, 1939. 15918/40.
 REMOVING BISMUTH FROM LEAD.—American Smelting and Refining Co. Nov. 7, 1939. 16002/40.
 APPLIANCE FOR CATALYTIC REACTIONS.—C. Picconi. Nov. 6, 1939. 16574/40.
 CHROMIUM METALLURGY.—M. J. Udy. Dec. 8, 1938. (Divided out of 29391/39.) 5677/41.
 CHROMIUM RECOVERY.—M. J. Udy. Jan. 25, 1939. (Divided out of 29392/39.) 5678/41.
 PREPARATION OF NUTRIENT SOLUTIONS for the production of citric acid by fermentation.—Prumyslova Akciová Společnost Kaznejov-Brasý. Dec. 22, 1938. 4822/40.
 LUBRICATING OILS AND LIKE OIL COMPOSITIONS.—Standard Oil Development Co. Dec. 2, 1939. 7009/40.
 ARTIFICIAL RESINS and coating compositions therefrom.—Carbide and Chemicals Corporation. Nov. 29, 1939. 14393/40.
 METHOD OF REGENERATING CATALYTIC and OTHER MATERIAL having carbonaceous deposits thereon.—Standard Oil Development Co. Nov. 24, 1939. 15442/40.
 TREATMENT OF SILICEOUS MATERIAL and the manufacture of glass. N. S. Garbisch. Nov. 29, 1939. 15518/40.
 METHODS OF STABILISING FORMALDEHYDE SOLUTIONS.—American Cyanamid Co. Nov. 28, 1939. 15879/40.
 COATING COMPOSITIONS containing blown drying oils.—E. I. du Pont de Nemours and Co. Nov. 25, 1939. 15974/40.
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 SYNTHETIC RESINOUS COMPOSITIONS.—British Thomson-Houston Co., Ltd. Dec. 1, 1939. 17040/40.
 CHEMICAL COMPOUNDS and method for preparing them.—Wingfoot Corporation. Nov. 29, 1939. 17080/40.
 MANUFACTURE OF FURAN CARBOXYLIC ACID AMIDES or similar acid ester amides.—J. R. Geigy A.-G. Dec. 2, 1939. 17111/40.
 MANUFACTURE OF SYNTHETIC RESINS.—E. I. du Pont de Nemours and Co. Nov. 30, 1939. 17171/40.
 CHLORINATION OF CHROMIUM-BEARING MATERIALS.—Pittsburg Plate Glass Co. Nov. 30, 1939. 17526/40.

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PURIFICATION OF SILICA SAND.—R. T. Hancock. Feb. 15, 1940. 535,455.

PRODUCTION OF SULPHONIUM COMPOUNDS.—N. V. de Bataafsche Petroleum Mij. March 31, 1939. 535,490.

PROCESS FOR THE REMOVAL OF THIO-ETHERS from mixtures containing thio-ethers and sulphonium compounds.—N. V. de Bataafsche Petroleum Mij. March 28, 1939. 535,466.

PROCESS FOR THE PRODUCTION OF colourless or light-coloured sulphonium compounds.—N. V. de Bataafsche Petroleum Mij. April 3, 1939. 535,468.

VISCOMETER FOR PRINTING INK.—Speedry Gravure Corporation. June 23, 1939. 535,551.

STRIPPING ELECTRODEPOSITED METAL SHEETS.—Anaconda Copper Mining Co. May 11, 1939. 535,560.

MANUFACTURE OF TITANIUM DIOXIDE PIGMENTS.—National Titanium Pigments, Ltd., I. E. Weber, and A. N. C. Bennett. April 24, 1940. 536,208.

AEROSOLS, particularly those having germicidal, disinfecting, insecticidal, or medicinal qualities.—T. L. Shepherd, S. R. Finn, E. O. Powell, and Shepherd's Industries, Ltd. July 27, 1939. 536,247.

MANUFACTURE OF ALKAMINE ESTERS OF di-allylic or aryl-allylic hydrophenanthrene series.—H. Fairbrother (N. V. Organon). July 28, 1939. (Cognate application, 25986/39.) 536,210.

MANUFACTURE OF ALKAMINE ESTERS OF di-allylic or aryl-allylic fatty acids.—Soc. of Chemical Industry in Basle. Aug. 5, 1938. (Cognate application, 22280/39.) 536,211.

PROCESS FOR PREPARING A CINCHOMERIC ACID DERIVATIVE.—Merck and Co., Inc. Sept. 3, 1938. 536,249.

PRODUCTION OF ARTICLES from an aqueous rubber dispersion.—Dewey and Almy, Ltd. (Dewey and Almy Chemical Co.). Aug. 30, 1939. 536,250.

MANUFACTURE OF AMINO CYCLIC SULPHONAMIDES and their derivatives.—Ward, Blenkinsop and Co., Ltd., B. P. H. Wiesner, and E. Katscher. Sept. 1, 1939. (Cognate application 33054/39.) 536,216.

METHOD OF PRODUCING PLASTIC CONTAINERS.—Monsanto Chemical Co. Sept. 16, 1938. 536,252.

PROCESS OF POLYMERISING ROSIN, and the product resulting therefrom.—Newport Industries, Inc. Sept. 28, 1938. 536,218.

PRODUCTION OF HYDROCARBONS by the catalytic conversion of carbon monoxide.—H. E. Potts (N. V. Internationale Koolwaterstoffen Synthese Mij. (International Hydrocarbon Synthesis Co.)). Sept. 30, 1939. 536,169.

PURIFICATION OF AROMATIC HYDROCARBONS by azeotropic distillation.—Woodall-Duckham (1920), Ltd., H. M. Spiers and H. K. Suttle. Oct. 26, 1939. 536,172.

MANUFACTURE OF SYNTHETIC POLYMERIC FILAMENTS, yarns, ribbons and like structures.—E. I. du Pont de Nemours and Co. Nov. 1, 1938. 536,177.

FURNACE FOR THE SEPARATION OF A METAL ALLOYED WITH OTHER METALS.—I. J. Foundaminsky and H. Loevenstein. Nov. 3, 1938. 536,258.

DISTILLATION AND PURIFICATION OF CARBONISABLE ORGANIC MATERIALS.—A. P. Lee. Nov. 3, 1939. 536,333.

TREATMENT OF GAS-SCRUBBING LIQUIDS.—Gas Light and Coke Co., W. K. Hutchison, and I. G. C. Dryden. Nov. 4, 1939. 536,185.

STABILISED VINYL RESINS.—Carbide and Carbon Chemicals Corporation. Dec. 13, 1938. 536,297.

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PREPARATION OF MAGNESIUM CHLORIDE FROM SEA WATER.—Ocean Salts (Products), Ltd., and B. A. Adams. Nov. 13, 1939. 536,266.

PROCESS FOR THE PREPARATION OF WATER-SOLUBLE DYE STUFFS of the anthraquinone series.—Sandoz, Ltd. Dec. 19, 1938. (Cognate application, 32531/39.) 536,303.

MANUFACTURE OF REFRACTORY BLOCKS.—Corning Glass Works. Jan. 3, 1939. 536,279.

PRODUCTION OF LUMINESCENT MATERIALS.—W. W. Triggs (Harsaw Chemical Co.). Jan. 25, 1940. 536,305.

DISTILLING PLANTS for tar, oils, and like liquid hydrocarbons.—T. O. Wilton. Feb. 27, 1940. 536,321.

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FURNACES FOR THE MANUFACTURE OF STEEL or alloy steels, iron, or alloy irons.—W. J. Campbell, A. H. Chiverton, and H. N. Gardiner. Aug. 31, 1939. (Divided out of 517,813.) 536,325.

METHODS OF SEALING GLASS TO METAL.—British Thomson-Houston Co., Ltd. April 7, 1939. 536,362.

PURIFICATION OF FUEL GASES.—W. C. Holmes and Co., Ltd., C. Cooper and D. M. Henshaw. April 9, 1940. 536,364.

DISTILLATION AND PURIFICATION of materials containing fatty acids.—A. P. Lee. Nov. 3, 1939. (Divided out of 536,333.) 536,366.

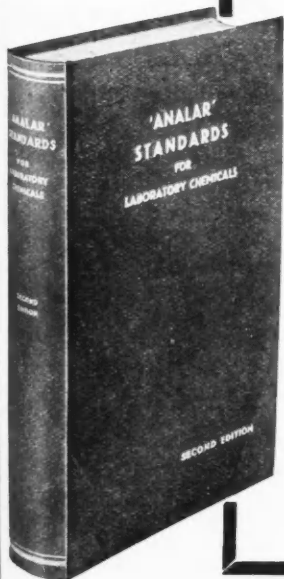
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